REVIEW

Comparative studies of how living circumstances influence medication adherence in ≥ 65 year olds

Running head: Living circumstances and adherence by the ≥ 65 year olds

Introduction

The World Health Organization estimates that 50% of subjects suffering from chronic diseases do not take their medicine [1]. In the older aged (those aged ≥ 65 years), adherence is a particularly serious problem because this group has an increased burden of symptoms and disease, leading to the use of more medicines, and an increased likelihood of nonadherence, which in turn leads to hospital admissions and progression of disease [2]. Ratified estimates of nonadherence among the older aged vary from 40 to 75% [3].

Many medicine-related and person-related factors have been identified as contributing to nonadherence to medicines in the older aged [2]. In addition, the older aged have many different types of living circumstances, which may affect adherence. There are different locations (urban, rural), different types of housing (in the community or in retirement villages), different living arrangements (living alone or with others) and different socioeconomic circumstances. However, there has been little attention as to whether these different living circumstances affect adherence to medicines in the ≥ 65 year olds, and this is the subject of this review.

In this review, older aged is considered to be ≥ 65 year olds. Evidence about whether living circumstances affect adherence to medicines in this group could come from logistic regression studies, or from comparative studies in different living circumstances. Our preliminary literature searches showed that although some studies have been undertaken among the older aged in specific living circumstances, they do not have a comparison to other living circumstances and thus it is not clear whether it is the living circumstance that is the determinant of the observed adherence. For instance, a study of the older aged in a rural setting reported low adherence to antidepressants [4], but as there was no comparison with other settings, it is not clear whether the adherence is related to rurality or to other factors. Thus, in the subsequent review, our aim was to determine whether comparative studies, including logistic regression studies, show that living circumstances affect adherence to medicines by

the ≥ 65 year olds. The living circumstances are location, housing, living arrangements, and socioeconomic status (SES).

Methods

A literature search of Medline was initially conducted (followed by the CINAHL databases and the Internet – Google – for additional references) for the terms 'adherence' (or compliance, concordance, persistence, discontinuation) with 'older' and 'aged' (or elderly or older adults) in combination with one of the following:

a) Locations: rural (number of hits = 111), remote (15), regional (58), city (176), urban (136) metropolitan (36), suburban (7), ethnic (151)/indigenous(2)/communities (111)
b) Housing: home (330), apartment (0), flat (0), house (15), granny flat (0), retirement village (3)
c) Living arrangements: alone (105), individuals (383), single (181), couple (87), widow (0), widower (0), married (59), partner (16), unmarried (19)
d) SES circumstances: socioeconomic (199), financial (340), money (4), income (138), budget (5), cost (276)

The authors read the English only abstracts. Most of the search results were not relevant to the review, as the criteria were comparative studies of living circumstances (including logistic regression) on adherence to medicines (not adherence to protocols) and was in the ≥ 65 year olds. The relevant papers and relevant referenced papers therein, were downloaded or obtained via interlibrary loan, and 18 are included in the results.

Results

Living in different locations

There are six studies comparing adherence to medicines in ≥ 65 year olds living in city/metropolitan/urban/suburban and regional/rural/remote communities, and two of these studies used logistic regression. There are various systems for defining city/metropolitan/urban and regional/rural/remote, and these definitions differ between countries. Thus, in this section, we have clarified the definition used in the studies included.

A 2004 Canadian study, comparing 319 older aged living in urban and rural settings, did not find any difference in adherence to medicines in these locations. In this study, rural was defined as living on a farm, acreage or in a village or town having a population of < 10000 and being > 20 miles from a major urban centre (≥ 10,000) [5]. The groups were reasonably well matched for age (mean of 83 years), assisted living setting (about 37% were in communal senior's residence, and the rest were in private homes), impaired vision, co-morbid conditions, cognitive impairment, depression symptoms, and regimen complexity, but not for other demographics. Thus, the rural group had more married people (35% vs 24%), fewer women (72% vs 86%), less high school education (37% vs 49%), fewer prescription drugs (mean of 5.8 vs 6.5) and fewer were taking ≥ 9 drugs (22% vs 32%). Adherence was measured using the Morisky scale and from answers to the question "Many people have trouble taking their medications as prescribed, thinking back to the last time you didn't take your medication(s) as prescribed, can you tell me why?" [5]. Subjects who reported only infrequent nonadherence were classified as adherent, while those who reported frequently making changes to their drug regimen were classified as nonadherent [5]. Using this method of measuring adherence, about 38% in each location were nonadherent [5].

One of the limitations to this Canadian study is that the groups were not matched for the number of prescription drugs. The older-age in the rural area were taking a lower number of prescription drugs, and fewer were taking ≥ 9 drugs, than those in the urban location. As an increasing number of medicines has been associated with nonadherence in the older aged [2], it is possible that the lack of matching of the number of drugs, is a factor in the finding of 'no difference' in adherence between the urban and rural settings.

Another Canadian study (2008) determined the discontinuation rates for methotrexate in 163 older subjects (mean age 73 years) in Québec with newly diagnosed rheumatoid arthritis, and found that by the end of the first and second years respectively, 68.2% and 49.8% of subjects had discontinued methotrexate [6]. There was no difference between discontinuation rates in rural settings versus urban residence [6]. In this study, the majority of subjects (78.9%) were from an urban setting [6], but the paper does not describe how 'urban' and 'rural' were defined.

The third study was of all Ontario (Canada) residents over 66 years, who had received a new prescription for an antihypertensive medication over an 8 year period [7], and used the same definitions for rural and urban as given above [4]. Using multivariable logistic regression, they showed that urban residents were

less likely to be adherent to antihypertensive medication (measured as the medicine possession ratio > 0.8) than rural residents [7].

The fourth study was a Romanian study (2010) that examined the factors that led to nonadherence among 922 older aged subjects (mean age 75 years) with cardiovascular disease [8]. Hospitalised subjects were divided into three groups based on the cause of hospitalization: nonadherence as the primary cause; secondary nonadherence resulting from other factors; and aggravating cardiovascular factors. In the group of 90 nonadherent subjects, it was reported that they lived equally in urban and rural areas [8]. However, the paper does not define urban and rural, and does not give the number of subjects in each of these categories. Thus, we do not know the percentages of nonadherent subjects from the different locations that were hospitalised due to nonadherence.

Fifthly, a study conducted in the US in 2011 examined medication persistence among rural and urban subjects (mean age 67) who were receiving medications after a stroke, and found no difference in persistence between locations [9]. Participants were from hospitals that were participating in the American Heart Association/American Stroke Association – Get With The Guidelines-Stroke Program [9]. Participants were categorised as living in rural (n = 426) or urban (n = 2294) locations by cross-referencing home ZIP code with metropolitan statistical area designation [9]. In the US, an urbanized area has 1000 people per square mile, an urban cluster is 500 people per square mile, and areas outside of urbanized areas or clusters are considered to be rural [10]. The groups were reasonably well matched for age, stroke type, medical history, and number of medications prescribed at discharge [9]. However, the rural group had more married subjects than the urban group (69% vs 58%) and the subjects from the rural group had less education (35%) than those in the urban group (43%). Nonpersistence was defined as medication discontinuation for any reason [9]. Persistence at 3 and 12 months was similar in the rural and urban settings for antiplatelet, warfarin, antihypertensive, lipid-lowering agents, and diabetic agents [9]. There was a similar fall in persistence in the rural and urban settings for each group of drugs between 3 and 12 months of treatment; antiplatelet persistence went down from ~90% to ~85%, and warfarin from ~83% to ~66% [9]. One of the limitations of this study is that the groups were not matched. It should also be remembered that the subjects were participants in a program to improve stroke management after discharge from hospital, and findings may not be indicative of subjects outside of this program.

Finally, a study of the management of osteoporosis prior to hip fracture in rural versus metropolitan was conducted in Western Australia [11]. In Australia, areas are classified as metropolitan (urban centre

population >100,000), rural (urban centre population ~10,000-99,999) and remote [12]. Of the 1130 subjects presenting with hip fractures, 19.2% were from rural areas, where the subjects were younger than those from the metropolitan areas (women 79.7 years vs 82.6 years; men 74.3 vs 79.9 years [11]. Logistic regression showed that living in a rural area was an independent predictor of lower use of vitamin D, calcium supplement and bisphosphonate, confirmed by pre-fractured prescription count [11]. In a one-year follow-up of 623 subjects, nonadherence measured by self-report to the fracture coordinator or not possessing the medication, as confirmed by the pharmacist, and nonadherence was lower among rural than metropolitan subjects for vitamin D (61.1% vs 72.0%), calcium (67.4% vs 76.0%), and bisphosphonates (44.0% vs 52.4%) [11].

Our searches did not reveal any comparative studies of adherence to medicines in subjects living in ethnic/indigenous/aboriginal communities in the ≥ 65 year olds, or any other age group.

Living in different types of housing

Our searches did not find any comparative studies of adherence of ≥ 65 year olds to medicines in subjects living in different types of housing (e.g. apartment, house) but did find two studies in retirement villages.

In Australia, there are three types of retirement villages; freehold, leasehold and rental, which may correspond to differences in SES. Freehold retirement villages are usually high SES, as the older aged who live there, own the land and house, while in leasehold retirement villages, which are the most common, the land belongs to the company that operates the retirement village, but the residents own the house/unit. Finally, there are rental retirement villages, where the residents rent their units, and these are usually low SES. Studies comparing adherence between 106 older aged subjects living in freehold, leasehold and rental retirement villages have shown that 92% of residents from a freehold retirement village were perceived to be adherent to their medicines, and not likely to have problems with adherence in the next 6 to 12 months [13]. However, in the leasehold retirement village only 55% of residents (mean age 83 years) were in this category [14], and in rental villages 50% or fewer older aged residents were presently adherent and likely to remain so [13]. Also, a comparison between a metropolitan and regional (semi- rural) rental retirement village, established that adherence was similar [13].

Living in different living arrangements

Our searches for comparative studies of ≥ 65 year olds, living in different arrangements (e.g. alone, couple, widow), yielded only six studies, and the results of these were inconsistent. In a study of ≥ 65 year olds admitted to acute hospital care, 103 had a history of nonadherence, and Col et al. (1990) suggested living alone may be associated with nonadherence [15]. However, in logistic regression study of 785 independently living older aged subjects (mean age 73.9 years), 66% of whom were living alone, Coons et al. (1994) showed no relationship between living alone and adherence, defined as taking medications more or less often than prescribed in the month preceding the interview for the study [16].

A 2005 study using logistic regression, conducted across 11 countries and which included 3881 ≥ 65 year olds, who received home care services, showed that being unmarried was associated with nonadherence, as reported by participants [17]. This was supported by a 2011 logistic regression analysis of 1965 ≥ 65 year olds in the Cohort Study of Medication Adherence Among Older Adults, which showed that being married reduced the decline in adherence to antihypertensive medications over time [18].

A study of 1491 women (mean age 67 years) with early breast cancer, used multivariate logistic regression to show that being unmarried was associated with greater adherence to adjuvant hormonal therapy, measured as the medication possession ratio [19]. In contrast, another study using multivariate regression analysis of 7399 of ≥ 66 year olds with early breast cancer showed that being unmarried was associated with nonadherence to hospital treatment with the anthracylines for early breast cancer [20].

Living in different SES circumstances

The effects of income/worth on adherence to medicines in the ≥ 65 year olds has been considered in six studies and the results are inconsistent. In the study by Col et al (1990) of 103 older aged subjects admitted to acute care hospital, medium income were a factor associated with nonadherence [15]. A 1994 logistic regression study by Coons et al (discussed in previous section) suggested that a higher income was associated with nonadherence [16].

A large Canadian study showed that, in those aged ≥ 66 years with low incomes, small copayments of $10 to $25 had no effect on the adherence, measured as the proportion of days covered, to β-adrenoceptor blockers after myocardial infarction [21]. A study of 103 older aged (mean age ~76 years), measured adherence to calcium/vitamin D and estrogen protocols in a clinical trial by pill count, and showed higher household income was associated with higher adherence rates [22].

Cost-related nonadherence is not filling a new prescription because of cost, stopping taking a medicine because of cost, or skipping doses to save money. Using this definition, and multivariate regression analysis, lower net worth was shown to be significantly associated with cost-related nonadherence among 3071 ≥ 65 year olds in the Health and Retirement study, which is a nationally representative cohort of older Americans [23]. Another study has shown that cost-related nonadherence due to lower incomes was similar among the ≥ 65 year olds who were cancer survivors, and those without cancer [24].

Our searches for comparative studies of adherence in the older aged living in different SES circumstances revealed one study in addition to the two in retirement villages, which were discussed previously [13,14]. The multivariable logistic regression study in Ontario of all residents > 66 years prescribed new antihypertensive therapy showed that those with higher SES (derived from census data by postal code) were more likely to be adherent [7]. The retirement village studies show that those living under middle (leasehold retirement villages) or low SES conditions (rental retirement villages) were less adherent than those living in high SES conditions (freehold villages) [13,14].

Discussion and conclusions

Our literature searches produced very few studies that were relevant to this review, and this indicates that the effect of living circumstances on the adherence to medicines in the older aged has not been studied extensively.

Locations: Four studies have not shown differences in adherence to medicines among ≥ 65 year olds living in rural and urban communities [5,6,8,9]. Three of these studies were of medicines in general [5,8,9] and one was of methotrexate [6]. However, a Canadian study reported higher adherence to antihypertensive medicines in rural than urban communities [7]. In contrast, an Australian study reported lower adherence to medicines for osteoporosis in rural than metropolitan areas [11]. Thus, to date there is limited evidence suggesting that the older aged living in rural areas may need to be targeted with help to adhere to medicines for osteoporosis.

Our searches did not reveal any comparative studies of adherence to medicines in subjects living in ethnic/indigenous/aboriginal communities in the ≥ 65 year olds, or any other age group. This is striking as it is well known that indigenous communities have poorer health outcomes than other communities (Australian aboriginal, Pacific [25,26]; Artic [27]; Latin America/Carabbean, [28]; American Indian, [29]).

Although indigenous communities have poor health outcomes (25-29), it is not known whether adherence to medicines is a component of this in the ≥ 65 year olds, as this has not been studied.

Housing/SES: Preliminary studies comparing retirement villages at different SES levels demonstrated that ≥ 65 year olds living in leasehold (middle SES) and rental (low SES) retirement villages may need extra help adhering to medicines compared to those living in freehold (high SES) retirement villages [13,14]. The effects of income/worth on adherence to medicines in the ≥ 65 year olds were inconsistent [15,16,21-24], and thus further studies are required.

Living arrangements: There is conflicting evidence as to whether living alone or being unmarried is associated with adherence/nonadherence in the ≥ 65 year olds [15-20]. There is no evidence as to whether other living arrangements in the older aged (e.g. widow/widower) are associated with adherence. Thus, further studies are needed to determine whether these living arrangements affect adherence to medicines in the older aged.

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